US007261950B2

(12) **United States Patent**
Fleming et al.

(10) **Patent No.: US 7,261,950 B2**
(45) **Date of Patent: Aug. 28, 2007**

(54) **FLEXIBLE, FORMABLE CONDUCTIVE FILMS**

(75) Inventors: **Robert J. Fleming**, St. Paul, MN (US); **Peter D. Condo**, Lake Elmo, MN (US); **Edward J. Anderson**, Somerset, WI (US); **Clark I. Bright**, Tucson, AZ (US)

(73) Assignee: **3M Innovative Properties Company**, St. Paul, MN (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/521,827**

(22) PCT Filed: **Aug. 15, 2003**

(86) PCT No.: **PCT/US03/25662**

§ 371 (c)(1),
(2), (4) Date: **Jan. 21, 2005**

(87) PCT Pub. No.: **WO2004/017701**

PCT Pub. Date: **Feb. 26, 2004**

(65) **Prior Publication Data**

US 2005/0247470 A1 Nov. 10, 2005

Related U.S. Application Data

(63) Continuation-in-part of application No. 10/222,465, filed on Aug. 17, 2002, now Pat. No. 6,818,291.

(51) **Int. Cl.**

B32B 15/04	(2006.01)
B32B 15/08	(2006.01)
B32B 15/082	(2006.01)
H05K 9/00	(2006.01)

(52) **U.S. Cl.** **428/626**; 428/34.1; 428/215; 428/216; 428/220; 428/332; 428/457; 428/461; 428/601; 428/673; 174/50; 174/350

(58) **Field of Classification Search** ..... 428/626, 428/673, 686, 457, 460, 929, 595, 601, 598, 428/625, 34.1, 409, 35.7, 461, 35.8, 332, 428/220, 215, 216, 336; 174/35 R, 51, 50; 359/585
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,302,002 A	1/1967	Warren
3,311,517 A	3/1967	Keslar et al.
3,529,074 A	9/1970	Lewis

(Continued)

FOREIGN PATENT DOCUMENTS

EP	0 810 452 A2	12/1997
EP	0 873 839 A1	10/1998
EP	0 944 299 A2	9/1999

(Continued)

OTHER PUBLICATIONS

Aluminum Foil with Conductive Adhesive Data Sheet, 3M Electrical Products Division, 1998, pp. 1-2, no month.

(Continued)

Primary Examiner—Michael E Lavilla
(74) *Attorney, Agent, or Firm*—Pamela L. Stewart; Lisa P. Fulton

(57) **ABSTRACT**

Electrically conductive films comprising a flexible support, an extensible metal or metal alloy layer, and a crosslinked polymeric protective layer have at least one permanently deformed curved region. The films can be light transmissive and can have regions of compound curvature, and the metal or metal alloy layer can be substantially continuous. The films have reduced susceptibility to fracture or corrosion compared to commercially available electromagnetic interference (EMI) shielding films.

17 Claims, 13 Drawing Sheets